SCIENCE

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COSTA RICA AT THE EXPOSITION.

BY FREDERICK STARR, UNIVERSITY OF CHICAGO, CHICAGO, ILL.

THE visitor in the Anthropological Building experienced a real delight and relief in coming upon the exhibit from Costa Rica. The displays in its neighborhood (from Mexico, Brazil and Paraguay) contained much of interest, but were inartistic and lacking in unity. The Costa Rica exhibit was in some ways a model.

The pavilion itself is quaint and attractive. A space of perhaps fifty feet by thirty is enclosed by a rather high board wall. Two doorways, facing each other, are in the middle of the longer sides. These doorways reproduce ancient flat-topped stone arches, decorated at their top corners with coarsely carved heads and squat figures. Large oil paintings hang on the external walls, one on each side of each doorway. They are set in wide gilded frames which are decorated with fret patterns copied from the stone ruins of Central America at the sides, while the upper border consists of enlargements copied from the grotesque bird and other figurines of gold which are found in the ancient graves. The pictures represent: (a) an Indian hut from Talamanca, (b) a view on the Uren River, (c) a chief's summer hut, in the Suerre Valley, dating back to 1544, (d) an Indian hut in San Bernardo, Sipurio, Uren Valley.

Entering the pavilion the visitor finds at the middle of the narrower sides gilded medalions, one of Vasquez de Coronado, the other of Isabel la Catolica. Each is the centre of a trophy composed of spears, bows, drums, nettings and fabrics of the modern Indians of Costa Rica. Upright frames, copper bronzed, with ornamentation derived from the old figurines contain full length and about life-size paintings of (a) a Talamanca Indian, with necklace of teeth, red ribbon hair-band, staff and breech-clout; (b) a Talamanca Indian woman with a little boy standing by her: the child is naked, while the woman wears a narrow red ribbon in her hair, a necklace of narrow strands, and a skirt cloth about her waist; (c) Indian of Guatuso, seated on a stone with hands on knees and wearing a breech-clout; (d) an Indian woman of Guatuso with waist cloth and cap. On the broader walls are also pictures, in horizontal frames, green bronzed and with ornamental patterns of frets and figurines. These pictures are in pairs, are on each side of each doorway and represent old Guetar graves, walled up with either rough rounded stones or narrow slabs. The details of construction are shown and the methods of archæological exploration. All of these oil paintings are by one artist—S. Llorente. The pavilion containing four handsome upright cases of oak, with plate glass doors, constructed for display on all four sides, and with a crimson or maroon background. In these and in flat cases about the sides of the pavilion is a choice series of archæological specimens. Objects too large for the cases are arranged on individual supports in various parts of the room.

The ancient art of Costa Rica is very near, if not identical, to that of Chiriqui, so well described by Mr. Holmes. In the series here shown there are many *metates* or stones on which corn is ground. Some of these appear to be quite recent and are no doubt used by the present Indians. They are made from a grayish, porous, volcanic rock, and usually present a rounded cornered, slightly basined, squarish upper surface, on which the grinding is done, supported by queer animal carvings. Stools of similar material are numerous. These present fairly flat wind tops, supported by a carved openwork base, in geometrical patterns or representing animals; sometimes a band about the upper edge is carved with a line of faces or grotesque heads. Very common are human heads, carved in the volcanic material, displaying considerable variety in feature, and some with tattooed patterns on the cheeks, or with headdresses. Less common, apparently, are the heads of mammalia, some of them admirably done. Full length human figures, about a foot in length, representing both sexes, the sexual organs being, at times, strongly marked, are not uncommon. These are commonly in the same position, the hands stiffly clasped upon the waist, the arms to the elbows closely against the sides. Yet more numerous are the quaint little figures, some six to ten inches high, squatting, with knees drawn up in front and the elbows resting on these. In some cases both hands are held to the chin or mouth; in others one hand is at the mouth and the other is on the knee. In almost, if not quite, all of these the head is exaggeratedly long and frequently bears a headdress or curious hair arrangement. Many hold a somewhat long cylindrical or barrel-shaped object to the mouth, with one or both hands. This object resembles somewhat an ear of corn, but the Costa Rica archæologists, I believe, consider it a cigar. In the flat cases is a large series of celts, or polished stone blades, mostly of the usual Antillean or Central American type. Many more special forms of stone objects might be mentioned, but we must pass to the fine series of pottery.

Here there are vases and jars of many forms in colors, commonly red or brown. Some are painted, others decorated with grotesque animal or human devices in relief; others quite plain. Many of the jars are tripod supported, and the legs are frequently hollow and with a little rattling ball of clay inside. Terra cotta whistles are plentiful—some simple, some in bird forms, some human figurines. Among these last are a few elaborate female figures, several inches high, with a considerable number of apertures to give a range of notes. Some plain ones are distinctly *ocarinas*. Rare, apparently, are the terra cotta rattles, copied after gourd rattles, and body and handle made in one piece. Very numerous are the little, flat, round, spoon-shaped censers, with handles wonderfully varied in ornamentation. Scores of pottery rings, like napkin rings, contracted usually about a middle zone, are plain, incised, or decorated with reliefs. In all the pottery, and of course we have not mentioned all the variety, there is similarity or identity with the Chiriqui work described by Mr. Holmes.

We find the same identity in the gold figurines, a fair series of which are displayed in two little wall frames. There are quaint and grotesque figures of birds, beasts, frogs and nondescripts. With these are a few of the little bronze bells (something like sleigh bells) and some thin, rather broad disks of gold, three of them with designs worked out upon them.

It must be plain to the readers that the little republic has done herself credit. The exhibit was at Madrid last year, and there an excellent catalog in Spanish was printed. The collection is displayed by the *Museo Nacional de Costa Rica*. Space does not permit tracing the history of this young institution, but we must say that the credit of the present exposition on its behalf is in large part due to three gentlemen: J. Arellano, M. M. de Peralta and A. Alfaro.

NOTES AND NEWS.

THE Contemporary Publishing Co. have a book of value to young mothers in "Nursery Problems," edited by Dr. Leroy M. Yale, medical editor of *Babyhood*.

—Estes & Lauriat have just ready for the holiday season a new volume of the Zigzag Series, "Zigzag Journeys on the Mediterranean," in which the author takes his readers to the classic cities along the shores of the historic sea, where they listen to many a folk-story and Oriental legend.

—Considerable interest is felt in the announcement that the first number of the *Psychological Review* will be published early in 1894. It will contribute to the advancement of psychology by printing original research, constructive and critical articles, and reviews. The growth of scientific psychology in America during the past few years has been rapid, and it is felt that a Review is needed which will represent this forward movement with equal regard to all branches and to all universities and contributors. The Review will be edited by Professor J. Mark Baldwin (Princeton) and Professor J. McKeen Cattell (Columbia), with the co-operation of Professor A. Binet (Paris), Professor John Dewey (Michigan), Professor H. H. Donaldson (Chicago), Professor G. S. Fullerton (Pennsylvania), Professor William James (Harvard), Professor G. T. Ladd (Yale), and Professor Hugo Muensterberg (Harvard). The *Psychological Review* will be published by Messrs. Macmillan & Co., of New York and London, and all matter pertaining to its business management should be sent to the publishers; communications regarding contributions to the editors direct. Subscriptions should be sent to the publishers. Price of single number, 75 cents. Subscription, $4.00 a year (the volume contains about 600 pages).

—Swan Sonnenschein & Co. announce a new book for immediate publication, under the title of "Modern Mystics and Modern Magic," by Arthur Lillie, containing a full biography of tha Rev. W. Stainton Moses, together with sketches of Swedenborg, Boehme, Mme. Guyon, the Illuminati, the Kabbalists, the Theosophists, the French Spiritists, the society of Psychical Research, etc.

—The translation of the Slavonic versions of the Book of Enoch by Mr. Morfill, announced for early publication by the Clarendon Press, will be delayed in its appearance, owing to the discovery of fresh Slavonic MSS. embodying a purer text and containing additional material. These MSS. have been found by Prof. Sokolov, of Moscow, who has generously placed them at the service of Mr. Morfill.

—Messes D. Appleton & Co. announce the Anthropological Series edited by Prof. Frederick Starr, of the University of Chicago. The books in this series will treat of ethnology, prehistoric archæology, ethnography, etc., and the purpose is to make the newest of all the sciences—anthropology—better known to intelligent readers who are not specialists and have no desire to be, although the series will be one which no special student can afford to ignore. While these books will be of general interest, they will in every case be written by authorities, and scientific accuracy will not be sacrificed to popularity. The first book in this series will be Woman's place in Primitive Culture, by Prof. O. T. Mason, of the Smithsonian Institution, wherein the author traces the division of labor between man and woman, which began with the invention of fire making—a most suggestive subject, and one of immediate interest. Other volumes will follow shortly.

—"King's Handbook of New York City," which was first published by Moses King, of Boston, about a year ago, has now appeared in a second edition and forms a handsome volume of a thousand pages. It opens with a brief sketch of the history of the city; and then goes on to speak of the harbor and the streets, the railways and the hotels, the modes of living among the various classes of the people, the charitable institutions and all other phases of New York life that a visitor would wish to know about. Several chapters are given to the government of the city, including the police and fire departments, and also to clubs, theatres and other centres of social life and amusement. Nor are the intellectual and moral interests of the people by any means neglected; but due notice is taken of the churches, schools, colleges and literary and scientific societies, and of the libraries. But, as New York is the commercial metropolis of the continent, a large space is necessarily devoted to the vast business interests that centre there; the banks, insurance business, manufactures, wholesale and retail trade and all other branches of industry being described as fully as most readers will desire. This second edition of the book has been carefully revised under the direction of Mr. King himself with the help of many assistants, and considerable new matter has been added. The illustrations, as stated in the preface, are over a thousand in number, of which three hundred first appear in this edition. The book is well printed on excellent paper, and contains an elaborate presentation of New York life and the varied interests of its people.

—The Appletons have issued a pamphlet entitled "The Philosophy of History," by Rev. E. P. Powell, the contents of which were originally a lecture before the Brooklyn Ethical Association. The author is firmly convinced that history can be treated in a scientific manner as an orderly sequence of causes; and he accordingly lays special stress on general tendencies and on the uniformities observable in the development of different nations, while he is rather inclined to underestimate the influence of great men. His principal aim in this work, however, is to trace the successive stages in the development of society from the primitive family to the state, the church and the industrial organization of the present day. Of course only the barest outlines of the subject are presented; but those who are not already familiar with the evolutionary philosophy of history will find here an epitome of it from one of its ardent disciples. Mr. Powell is thoroughly optimistic, maintaining not only that humanity has always progressed in the past, but also that it will continue to progress in the future. In the appendix are given the replies and criticisms of two other men, who were present when the lecture was delivered; and their remarks are worthy of attention in connection with the author's own. We are not so sanguine as Mr. Powell is that the course of history will soon be explained, but we think it ought to be treated in a philosophic spirit, and so we are glad to have the subject discussed.

—The Open Court Publishing Company have issued, in pamphlet form, the address on "Our Need of Philosophy," delivered by Dr. Paul Carus at the World's Congress of Philosophy, in Chicago, in August last. It opens with a few remarks on the importance of philosophy to mankind in general and on the conditions on which its development depends; and then, after a brief sketch of the leading characteristics of German, French and English philosophy, dwells on the special need of philosophy to-day for the guidance of American life. Dr. Carus pleads not only for a deeper study of philosophical problems, but also for the teaching of philosophic truth to the masses of the people, and justly remarks that "the United States of America are so constituted that we have but one choice left us: we must educate the masses, or go to the wall." He dwells on the great opportunity that we Americans have before us, but reminds us that "an opportunity can be lost as well as improved." The address, though short, is very good, and will interest everyone who cares for philosophy.

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Attention is called to the "Wants" column. It is invaluable to those who use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

ENGINEERING LABORATORIES.

BY R. C. CARPENTER, ITHACA, N. Y.

IT IS the object of the present article to point out how an Engineering Laboratory can be equipped for a comparatively small expenditure.

In discussing the subject I shall confine myself purely to the educational features and will not consider the laboratory as a place for investigation or solution of advanced engineering problems. I may also be permitted to say that there are few colleges in America, perhaps in the whole world, in which students, as a rule, gain sufficient culture, or indeed have sufficient time to undertake the work of investigation of engineering problems, in an undergraduate course. It is only in those courses where a great number of graduates are to be found that problems of research have any legitimate home.

The undergraduate laboratory should be equipped so as to demonstrate in a practical and convincing way the principal laws or facts that the student must master in order to finish his course. Its course of instruction should be such as to require systematic work of the student, teach him how to observe, how to use apparatus, how to deduce conclusions from his mass of data and finally how to make a neat and systematic report of his work.

Having that object in view, the best methods or means of execution remain to be sought. In this respect two courses will be open, one, which at first may seem simpler and better, consists in laying out on a single schedule all the experiments that can possibly be performed by the students, with the apparatus at command. Students are assigned to these various experiments as they report for duty.

The other consists of a course in which are put the more important experiments; every student to take in turn each experiment. In laying out a system of such work it will be necessary to have a series of independent experiments for each term, so that the order in which they are taken is immaterial.

From personal experience I am positive that the latter is the only way to successfully conduct an engineering laboratory, unless you are possessed of an almost infinite equipment, an unlimited patience, and an entire disregard of order, and even then a great number of students, working in as many lines, would be certain to cause vexation, delay or trouble in some direction. Besides all this the amount accomplished by an individual student is generally small, since a large part of his time has to be devoted to preparation, looking up apparatus, and in finding people willing to lend.

By arranging for a certain definite number of experiments each day, which are sufficient for all the students reporting that day, and repeating these day by day until each student has performed each experiment, the conditions are not only more favorable for systematic orderly work, but a minimum amount of apparatus will be required and more efficient and better directed instruction can be given. In such a case the apparatus is easily kept where needed and in good order, and the student can devote the required time purely to the experimental work. I will not deny that the work of preparation and of looking up apparatus is of benefit to the student, but it is not experimental work and should have a place in some other part of the curriculum.

I hope I may be excused for devoting so much time to this discussion, but I feel that it is an important matter, and vital to the subject of the article. In the physical or chemical laboratory I believe that the best results are obtained by the first system, since working apparatus is portable, experiments quickly arranged and the results more definite and constant in character, and the same system is likely to be applied to engineering, thought not being given to the facts, that engineering constants are seldom more than coefficients, and the value is affected by the method used in testing. In many engineering experiments the method is of equal or greater importance than the results.

For the reasons just stated I would advise a limited number of experiments each term and require each student to take the course as laid out. I am positive that the better instruction obtained will more than offset any loss due to the want of selection.

The nature of these experiments must depend upon the apparatus, but I will, however, refer to a course which might be pursued in case the equipment was extremely small. Suppose, first, the course to be in civil engineering, in which case the laboratory work will relate principally to strength of materials and hydraulics, field work and astronomy, the two latter will not, however, be included in this laboratory course. The apparatus needed might be certainly as much as could be purchased, but one testing machine of 50,000 pounds capacity, arranged for testing in tension, compression and transverse, a cement testing machine, a small drop of 100 pounds falling ten feet, and a wooden beam twenty feet long and four by eight inches in dimensions, will be found to be sufficient apparatus to keep four experiments, two men at each, in operation the entire time. The cost of such apparatus will probably not exceed $1,000 and possibly might be less.

The experiments that might be performed are almost infinite in variety in the line of strength of materials, and the students could not only obtain skill but also valuable knowledge respecting the properties of materials.

Some of the most interesting experiments are performed with little or no apparatus, as, for instance, by loading a beam in different ways and studying the effect on the elastic cam produced by the load in various positions.

For hydraulics, little is needed but what can easily be made by resident mechanics, excepting tanks and weighing scales. Weir notches and hook gauges are readily made and ensure materials for an almost endless variety of experiments.

Small water motors and pumps are quite inexpensive, so that probably for $500 an equipment that will give six experiments and keep twelve men at work constantly can be had. If a student could spend six hours a week, which is about the amount required to complete a single experi-

ment and write a complete and satisfactory report, there would be found outlined, as above, sufficient for three terms or one year's work.

For mechanical engineers the field must be broadened out so as to include the various classes of prime movers, engines, boilers, gas engines, etc.; but in this case as in the other, with a few small pieces of apparatus, and a few accurate measuring instruments, a great number of useful and valuable experiments can be performed.

For the purpose of investigation and study, a tool or machine rejected for inefficiency or wear by the owners, will often serve as good a purpose as a new machine. The results obtained often point out a line of practice which should not be followed, and this becomes an enduring lesson on the student's mind.

I have elsewhere endeavored to point out in detail methods of performing engineering experiments, and I wish to call to mind here my emphatic opinion that so far as educational results are concerned, the equipment required need not be so expensive that it cannot be furnished in any college of engineering in the country. It is, perhaps, hardly necessary to remark that a little apparatus, employed to advantage, is of more benefit than a large collection used merely to adorn a cabinet or to advertise a college. My own experience leads me to believe that no species of instruction is of as much value to the student as that in which he participates, and knowledge obtained by "feeling" it out, by proving by actual experiment, remains with one and is more readily at command than that obtained purely through the senses of sight and sound.

This leads me to place a high value on this species of instruction, but above and aside from all this is the fact that engineering is an art, founded on imperfect applications of the science of mechanics; all that we get in this line, every engineering truth, must be proved, if not originated, by the laborious processes which are first taught in an engineering laboratory; and he who would advance his profession must be skilled in all that relates to observation and investigation.

ANIMAL BIOLOGY IN HIGH SCHOOLS AND COLLEGES.

BY W. XAVIER SUDDUTH, A. M., M. D., UNIVERSITY EXTENSION LECTURER AND PROFESSOR OF EMBRYOLOGY, ETC., IN THE UNIV. OF MINNESOTA, MINNEAPOLIS, MINN.

No one, at the present day, questions the importance of animal biology in the curriculum of all well conducted high schools and colleges as well as in the better endowed universities and professional schools. The question is rather, how may this be accomplished? That there is a sad lack of competent instruction in these branches, even in schools that make it their business to educate teachers, cannot be denied.

The need is only too apparent but the laboratory method is not way the to remedy the defect in our smaller colleges and high schools, because it is beyond their financial ability to secure it.

This obstacle may, however, be overcome to a certain extent by the use of the stereopticon and lantern slides which may be had at a cost that is within the reach of any school board. The price of stereopticons has, within the past few years, been materially reduced and the quality greatly improved, so that now a good working lantern with suitable accessories for projecting photo-micrographs on the screen, for ordinary class work, may be had for a sum as low as fifty dollars. Then again the process of reproducing histological subjects has of late been so developed that they may be had from almost all dealers in school supplies at a nominal outlay. Very little has, however, been written upon this method of illustrating lectures on physiology and hygiene in our public schools and it is with this in view that I have undertaken the present article.

I have no hesitancy in saying, at the outset, that a better understanding of the histology of tissues can be imparted to a greater number of students in a given space of time by this means than can be obtained by the laboratory method. I do not desire to be understood as decrying the *practical working laboratory*. Where time and equipment are sufficient no better method can be had for studying biology in all its phases, but where either of the above essentials is lacking the lantern becomes a valuable substitute, and even where the laboratory method is employed I have found the lantern a very valuable adjunct in imparting a general knowledge of the subject. As a method of illustrating didactic lectures on histology I consider it far ahead of charts. In its use the matter of "personal equation" is reduced to the minimum, and it carries a more vivid impression of the original tissue because of the fact that it is a photograph. In the use of the lantern the educated senses are appealed to and valuable time saved that in the laboratory method is spent in learning the technique of the microscope which in after years is of little avail unless the individual continues in practical Laboratory work. If the object sought is the making of microscopists and original investigators then use the laboratory method combined with the lantern for class demonstration, but if time or equipment is a desideratum the lantern will be found to be fully adequate for good class instruction. Ten years' experience as a teacher of biology leads me to speak thus positively on this question. Trained in the best German laboratories I naturally followed their methods when I began teaching. Gradually the lantern was introduced to illustrate didactic lectures. At first use was made of the oxyhydrogen lime light for projecting actual tissues upon the screen. Many valuable specimens were lost by overheating. Various cells were introduced to prevent this, but they shut off the light to such an extent as to minimize the result desired to be obtained. I was led to substitute solar light for the lime light, but the uncertainty of the results led to its abandonment in favor of photomicrography, and now with an inexpensive oil lantern better results are obtained by this process than formerly with the most expensive stereopticons, under the most favorable conditions. I make my own photomicrographs and find it a delightful recreation. In past years I used to keep on hand an extensive cabinet of microscopic slides for reference. These have latterly been discarded for the photomicrographic negative. My custom now is to photograph all points of especial value as I am studying and file the negatives away for future use. But little time is required for the work when one has a dark room handy which is fitted up for it.

The objection has been offered to photomicrography in that it only reproduced the slides in light and shade. To overcome this objection I have invented a process by which it is possible to reproduce the original stains of the microscopic slide in the lantern positive, in double stain if necessary, and that without hand-painting as was formerly required.

In conclusion let me reiterate that by adopting the lantern and photomicrography the subject of animal biology may be successfully brought before the classes of our high schools and colleges, now debarred from its study by lack of suitable equipment.

THE SILVER QUESTION AND BIMETALISM.

BY J. JAMES COUSINS, ALLERTON PARK, CHAPEL ALLERTON, NEAR LEEDS, ENGLAND.

I DO not think any apology is needed in introducing the silver question as a scientific one, as no subject can have a deeper interest for the American scientist at the present time, than a consideration which can furnish one particle of elucidation to this most interesting and complicated question.

In order to arrive at anything like a fair solution (and that is the only one the world which is both our debtor and creditor will listen to) we must divest it of all local and national considerations, because the fact of nearly all the silver in use being the product of America, a certain amount of prejudice against American opinions and actions is engendered thereby.

We find it stated (Wealth of Nations Vol. 1,743. M'Culloch's ed.)"Every prudent man, in every period of society, after the establishment of the division of labor, must naturally have endeavoured to manage his affairs in such a manner as to have at all times by him, besides the peculiar product of his own industry, a certain quantity of some one commodity or another, such as he imagined few people would be likely to refuse in exchange for the produce of their industry."

The question is, do we find in silver such a commodity? Do our creditors all over the world exhibit a willingness to accept payment for our debts in silver? The answer is obviously "no."

In the event of our succeeding in enforcing such payment as a legal tender, it is certain that those who did so would buy upon worse terms than those who paid in gold, a metal which all the commercial world is craving for.

Now is this craving merely sentimental, or is there good ground for its existence?

One thing is certain that large and important countries one after another are abandoning the double standard, and silver is the one sacrificed, the reason for which is not far to seek.

In order to successively maintain a double standard, we must be able to fix an unfailing ratio of value between the two metals, let us see if that is possible between gold and silver.

We find that in the time of Julius Caesar the ratio of value between the two metals was 9 to 1; in the beginning of the present century 15½ to 1, and now 27½ to 1, which seems to point to an impossibility of establishing a ratio of value, it is obvious that to measure length a standard must have fixed length, to measure value it must have fixed value, attempts have been made by powerful syndicates to give an enhanced value to copper, iron, tin, cotton, corn, etc., all of which have ultimately broken down.

Suppose for a moment the government of the great commercial countries of the world were to establish a bimetallic standard and accept silver as one of them. In order to be of any value to the silver interest, silver must be a legal tender to any amount.

From its depreciating tendency it would soon become the one medium of exchange, and gold would assuredly be hoarded, which would prove most inconvenient, for in the event of your presenting say a cheque of $5000 for payment the banker, whoever he may be, would insist upon the customer taking silver because it paid him (the banker) best to do so, and it is difficult to realise the position of the customer under such circumstances, whilst the trouble and difficulty of international exchange would be greatly enhanced.

I propose in a later article to introduce the subject of an international clearing house, the relief of which to the metallic exchange can only be appreciated by those who have a thorough knowledge of the advantages of the London clearing house, where the bulk of the trade of the United Kingdom is settled for, upwards of twenty millions sterling per day, without the interchange of a single coin.

These two subjects are so interwoven that one cannot be fairly or properly considered without the other, but this article has already run out its proper length for your columns so that I dare not do more than hint at the subject of an "International Clearing House."

I may just say in conclusion that in my opinion the "letter" of Mr. Farley who was elected President of the National Board of Trade at Washington last January, and which may be read in the official report of the proceedings of that meeting, whilst it contains many valuable suggestions upon the silver question, would be found as a whole to be thoroughly unworkable.

FAITH IN THE INTEGRITY OF THE INTERSTELLAR MEDIUM.

BY DE VOLSON WOOD, HOBOKEN, N. J.

THAT space is not void, is conceded. That it is filled with a medium capable of transmitting light and heat is not questioned. This medium is believed to be uniform in density and elasticity, but the exact nature of its constitution is unknown. Some believe it to be molecular like gas, while others question if its structure has been correctly defined. It makes no direct impression upon the senses, and is known only through effects produced; and yet, whatever be its nature, it is known to transmit a wave of light at the rate of 86,300 miles per second, there being, as a mean value, within the spectrum, about 50,000 waves in an inch, or more than 60,000,000,000,000,000 in the distance passed over in one second. When it is considered that waves are transmitted through this medium in all conceivable directions with the same velocity, some faint conception may be had of its intense activity. The complicity of the waves is transcendent, for each shade of light has its own wave length, there being about 36,000 waves to the inch in red light, and more than 64,000 in violet, and outside the visible spectrum there are less in number in one direction and more in the other. Every self-luminuous body in the universe is imparting to this medium waves of these varying lengths all travelling with a sensibly constant velocity. When it is considered that the countless number of stars and suns, scattered promiscuously throughout limitless space, are producing such waves, radiating from each in all possible directions, it would seem that, if they did not actually destroy each other they would so interfere as to produce "confusion worse confounded" and the impressions upon the eye of an observer would be valuless. But, on the contrary, the scientist believes that this medium truly and faithfully transmits to the remotest space every wave imparted to it, preserving with the strictest integrity its individuality —except that planets and other solid bodies may destroy the waves they intercept.

A star ten or more years ago started a wave which just now, we will suppose, arrives at the earth and writes its own record on some sensitized plates, though the star may be 6,000,000,000,000 miles away. From these impressions the physicist finds—perhaps—that the star is double, although the most powerful telescope had failed to divide it, that the two revolve about each other, and he determines there probable orbit, masses and velocities. Or, perhaps he finds, as in the remarkable star of 1892, that it changes from a star to a nebula in a few months. In all this, no question is raised in regard to the integrity of the record, nor whether in its long journey any planet, sun, comet, meteorite or nebula has interfered to modify

or in any way corrupt the story it was commissioned to tell. What faith! But this is little more than the shadow of an illustration; for Herschell, the astronomer, thought it probable that we can see nebulæ from which it has taken light 300 000 years to reach the earth, during which time the interstellar medium has been faithful in transmitting at the rate of more than 11,000,000 miles per minute the impulse committed to it, notwithstanding its path has been crossed and recrossed by other waves without number. Pen cannot adequately describe the transcendant properties of this wonderful medium called the "lumineferous æther" nor to highly exalt that faith which enables one to implicitly believe the truthfulness of the stories committed to him. One is led to exclaim with the Psalmist "Oh Lord! how manifold are thy works, in wisdom thou hast made them all."

CITY BIRDS OF DENVER, COLORADO.

BY HORACE G. SMITH, DENVER, COLO.

PERHAPS some of your readers would like to know something of the city birds which come about our dwellings in Denver, Colorado, and wherein they differ from the familiar species so near to the hearts of the bird lovers who live east of the Mississippi River.

To be sure, many of the Eastern species, whose geographical range is so extensive find their way, across the Great Plains, to our city at the base of the Rocky Mountains, still true to the type of their eastern friends, but for the most part the species undergo a radical change when we enter the high and arid regions of the Great Plains and become of a bleached and faded appearance which gives rise to subspecies or varieties; or, as is often the case, a new species takes the place of its eastern relative.

Among those species which we have in common, the Yellow warbler (*Dendroica aestiva*) is perhaps one of the most familiar summer residents, and its neat little nest is often built in the shade trees along our streets or in the shrubbery of some garden, and its familiar song is heard even in the heat of midday, when most birds are silent.

Scarcely less noticeable is the Kingbird or Bee Martin (*Tyrannus tyrannus,*) the Cliff swallow and the Barn swallow, whose habits are well known to most readers and may not be detailed here, though I may mention that a pair of Barn swallows has returned to the writer's barn-loft for about fifteen successive years, and when unmolested has reared two broods per season. Their mode of entrance was through an open window, which they usually found shut upon their return migration in the spring, but would soon make their presence known by repeated scoldings and flutterings before the glass and would enter and take possession as soon as the window was opened. Hence I suppose it to be the same pair, though the evidence is not conclusive.

Perhaps the most conspicuous of our summer birds is Bullock's oriole, which takes the place of the Baltimore oriole of the east. This brilliant bird is a common breeder over the entire city, wherever trees are found in which to built its swaying nest, and it is not an uncommon occurrence to find several nests—which have been built in successive years—in the same tree.

I have often watched these birds in the early morning, searching for insects in the arc light globes; their method being to enter the globe for any tempting morsel and then flying to the next in line.

Speaking of the electric lights reminds me of the little House finch (*Carpodacums in frontalis*) whose song often cheers us in the winter time, when most birds are silent. It would be hard to part with this little bird, for his song is rich and pleasing. Being a resident with us, they rear their young near to our homes, usually in trees or crevices of buildings, but being progressive they have lengthened their breeding season by taking advantage of the heat furnished by the electric lights, by building their nests in the lamp shades above the lights, thus being entirely protected from the weather.

The past summer I was told by one of the trimmers that nearly every light on his beat contained one of these nests.

Among other summer residents, more or less common I may mention the Western robin, Mountain bluebird, Warbling vireo, White-rumped shrike, Lazuli bunting, Black-headed groobeak, Western chipping sparrow, Arkansas goldfinch, western meadow lark, Say's phoebe, western wood pewee, Mocking bird and western Kingbird, the latter being a cousin of the Bee martin and having all the habits of his querulous relative.

The Pine siskin (*Spinus pinus*), though considered a migrant with us, occasionally rears its young here; a pair having built their nest in an evergreen in the writer's yard. This is not so surprising when we consider that its natural summer home among the coniferous forests may be found within fifteen miles of Denver, in the mountains.

Parkman's House wren (*Troglodytes ædon parkmanii*) seems less familiar than the eastern bird, at least in the manner of its nesting, for, though not uncommon in our city in migration, it seems to retire to the thickets along our streams to build its nest; usually taking possession of some crevice or deserted woodpecker's hole.

A few winter birds remain with us but perhaps none so common or well distributed as the House finch before mentioned. The western Tree sparrow, Mountain chickadee, Long tailed chicadee, McCown's longspur, Cassin's finch, Harris's and Batchelder's woodpeckers, the Northern shrike and several varieties of Juncos or snowbirds, though the Desert horned lark (*Otocoris a. arenicola*) is the familiar "snowbird" of the region and is often seen in numbers in the outside streets, especially when snow is on the ground.

At other times it is not often noticed though it may be present, for its plumage harmonizes well with its surroundings. Besides these we have an occasional visit from the snowflakes, Red polls and some others.

I make no mention of the host of migrants, which fill our city during the migrations, including rare and curious species of warblers, sparrows, thrushes, flycatchers etc., nor of other summer residents of the region, whose summer haunts are found in woodlands or upon the plains, for this is essentially a paper upon "city" birds. These may receive our attention at some future time.

OVERHEAD SOUNDS IN THE VICINITY OF YELLOWSTONE LAKE.

BY EDWIN LINTON, WASHINGTON, PA.

WHILE engaged in making certain investigations for the United States Fish Commission in the summer of 1890 my attention was called to an interesting phenomenon in the vicinity of Yellowstone Lake, of which I am pleasantly reminded by the following brief but vivid description in a recent report by Prof. S. A. Forbes.

Under his description of Shohone Lake, Professor Forbes, in a foot note, thus alludes to this phenomenon:

"Here we first heard, while out on the lake in the bright still morning, the mysterious aërial sound for which this region is noted. It put me in mind of the vibrating clang of a harp lightly and rapidly touched high up above the tree tops, or the sound of many telegraph wires swinging regularly and rapidly in the wind, or, more rarely, of faintly heard voices answering each other overhead. It begins softly in the remote distance, draws rapidly near with louder and louder throbs of sound, and dies away in

the opposite distance; or it may seem to wander irregularly about, the whole passage lasting from a few seconds to half a minute or more. We heard it repeatedly and very distinctly here and at Yellowstone Lake, most frequentquently at the latter place. It is usually noticed on still bright mornings not long after sunrise, and it is louder at this time of day; but I heard it clearly, though faintly, once at noon when a stiff breeze was blowing. No scientific explanation of this really bewitching phenomenon has ever been published, although it has been several times referred to by travellers, who have ventured various crude guesses at its cause, varying from that commonest catch-all of the ignorant, "electricity," to the whistling of the wings of ducks and the noise of the "steamboat geyser." It seems to me to belong to the class of aërial echoes, but even on that supposition I cannot account for the origin of the sound."

(*A Preliminary Report on the Aquatic Invertebrate Fauna of the Yellowstone National Park, etc. Bulletin of the United States Fish Commission for 1891, p. 215. Published Aprtl 29, 1893*).

In a paper which was read before the Academy of Science and Art of Pittsburg, Pa., March 18, 1892, entitled "Mount Sheridan and the Continental Divide," I recorded my recollections of this phenomenon and reproduce them here with no alteration. Although the style is, perhaps, somewhat lacking in seriousness, the descriptions were made from notes taken at the time and written out while the memory of the facts was still fresh. Indeed, even now, after a lapse of three years, I have a very distinct recollection of the sound, vivid enough at least to teach me how imperfect my description of it is. Words describe an echo very inadequately when one is in ignorance of the original sound, and especially so when he is in doubt as to whether the sound is the echo of a noise or the noise itself.

Following is the account of these overhead noises given in the paper alluded to above and published soon after by the academy:

Overhead Noises.—The last topic which I shall discuss in this somewhat desultory paper, is what I shall call overhead voices.

Lest I be thought to be indulging in some ill-advised or disordered fancy I shall first quote from Hayden's *Report for* 1872, *on Montana, Idaho, Wyoming, and Utah.* Mr. F. H. Bradley, p. 234, in that part of his narrative which relates their visit to Yellowstone Lake, says: "While getting breakfast. [This was near the outlet of the lake] we heard every few moments a curious sound, between a whistle and a hoarse whine, whose locality and character we could not at first determine, though we were inclined to refer it to water-fowl on the other side of the lake. As the sun got higher the sound increased in force, and it now became evident that gusts of wind were passing through the air above us, though the pines did not as yet indicate the least motion in the lower atmosphere. We started before the almost daily western winds, of which these gusts were evidently the forerunners, had begun to ruffle the lake."

With this warrant I shall proceed to decribe as well as I can my impressions of these overhead noises, which appear to belong exclusively to the lake region of the Park.

The first time I heard them, or it, was on the 22d of July, about 8 A. M., on Shoshone Lake. Elwood Hofer, our guide, and I had started in our boat for the west end of the Lake. While engaged in making ready for a sounding on the northern shore, near where the lake grows narrow, I heard a strange echoing sound in the sky dying, away to the southward, which appeared to me to be like a sound that had already been echoing some seconds, before it had aroused my attention, so that I had missed the initial sound, and heard only the echo. I looked at Hofer curiously for an explanation. He asked me what I thought the sound was; I immediately gave it up and waited for him to tell me, never doubting that a satisfactory explanation would be forthcoming. For once this encyclopedia of mountain lore failed to come up to date. His reply was, that it was the most mysterious sound heard among the mountains. From the first this sound did not appear to me to be caused by wind blowing. Its velocity was rather that of sound. It had all the characters of an echo, but of what I am not even yet prepared to give an altogether satisfactory answer. I am afraid that my conclusions are about as satisfactory as those of the Irishman, who having been sent out from camp in the night to investigate a strange noise believed to be made by some wild beast, returned with the announcement that " it was nothing at all, only a noise just." Upon our return to camp I questioned both our guides and one of the packers, who had had much experience in the mountains. They agreed substantially in what they had to say about it. They had never heard it farther west than Shoshone Lake, nor farther east than Yellowstone Lake, and not at all north of these lakes. Hofer thought he had heard it once about 30 miles south of Yellowstone Lake. Dave Rhodes had heard it usually shortly after sunrise and up to perhaps half-past eight or nine o'clock. Hofer said that he had heard it in the middle of the day but usually not later than ten o'clock A. M. Neither of them remembered to have heard it before sunrise.

On the following morning we heard the sound very plainly. It appeared to begin directly overhead and to pass off across the sky, growing fainter and fainter towards the southwest. It appeared to be a rather indefinite, reverberating sound, characterized by a slight metallic resonance. It begins or is first perceived overhead, at least, nearly every one, in attempting to fix its location, turns his head to one side and glances upward. Each time that I heard the sound on Shoshone, it appeared to begin overhead, or as one of the men in the party expressed it "all over," and to move off to the southwest. We did not hear the sound while on Lewis or Heart Lake. The next time I heard the sound was on August 4th, when we were camped on the "Thumb" of Yellowstone Lake. Professor Forbes and I were out on the lake making soundings about 8 A. M. The sky was clear and the lake was quiet. The sun was beginning to shine with considerable power. The sound seemed loudest when overhead, and apparently passed off to the southward, or a little east of south. It had the same peculiar quality as that heard on Shoshone Lake, and is just as difficult to describe. There was the same slight hint of metallic resonance, and what one of the party called a kind of twisting sort of yow-yow vibration. There was a faint resemblance to the humming of telegraph wires, but the volume was not steady nor uniform. The time occupied by the sound was not noted, but estimated shortly afterward to be probably a half a minute As I heard it at this time it seemed to begin at a distance, grow louder overhead where it filled the upper air, and suggested a medley of wind in the tops of pine trees, and in telegraph wires, the echo of bells after being repeated several times, the humming of a swarm of bees, and two or three other less definite sources of sound, making in all a composite which was not loud but easily recognized, and not at all likely to be mistaken for any other sound in these mountain solitudes, but which might easily escape notice if one were surounded by noises. On August 8th, at 10.15 A. M., Professor Forbes and I heard the sound again while we were collecting in Bridge Bay at the northern end of the lake.

While on Shoshone Lake I ventured the suggestion that the sound might be produced beyond the divide east

of us, and be reflected from some upper stratum of air of different density from that below. Hofer evidently considered himself responsible for an explanation of the origin of the sound, and frequently remarked that it reminded him of the noise made by the escaping steam of the so-called Steamboat Geyser, on the eastern shore of Yellowstone Lake, about 6 miles from the outlet. I passed between Steamboat Point and Stevenson's Island twice, but was not near enough either time to hear the escaping steam. Moreover, on each occasion the wind was blowing a lively breeze in the direction of Steamboat Point. On the afternoon of August 9th, at 3.20 P.M. while in a row-boat on the south eastern arm of Yellowstone Lake, near the entrance of the upper Yellowstone River, I heard a sound overhead, like rushing wind, or like some invisible but comparatively dense body moving very rapidly through the air, and not very far above our heads. It appeared to be travelling from east to west. It did not have the semi-metallic, vibrating, sky-filling, echoing resonance of the overhead noises that I had heard before, and was of rather shorter duration. It had, however, the same sound-like rapidity of the other. The sky was clear except for a few light fleecy and feathery clouds, and there was just enough wind blowing to ruffle the surface of the water. If this sound was produced by a current of air in motion overhead, it is difficult to understand why it did not give some account of itself, either in the clouds that were floating at different levels in the upper air, or among the pines which covered the slope that rose more than 1000 feet above our heads, or on the waters of the lake itself.

I am inclined to attribute the typical echoing noise to some initial sound, like that of escaping steam for example, from some place like Steamboat Geyser, and which is reflected by some upper stratum of air, that is differently heated from that below by the rays of the sun as they come over the high mountain ridges to the east of the lake. The sound may thus be reflected over the low divides west to Shoshone, and south to Heart Lake, or even farther in the direction of Jackson's Lake. I am not strenuous for this theory, and will be glad to hear a better explanation of this phenomenon. I have a dim recollection of some legend of phantom huntsmen, and a pack of ghostly but vocal hounds which haunt the sky of the Hartz Mountains. Can any one tell whether there is any natural phenomenon belonging to mountains or mountain lakes, which could give foundation to such legend?

The phenomenon has not yet been successfully explained, and I do not know that any similar phenomenon has been observed elsewhere.

It is to be hoped that some one will investigate the matter soon and give a scientific explanation of its cause.

THE PLACE OF MUSEUMS IN EDUCATION.

BY THOMAS GREENWOOD, LONDON, ENGLAND.

THE most casual observer of educational methods could not fail to notice that the receptive mind of a child or a youth learns from an infinite variety of sources. We all know that we begin at one end of education, but there is no period in life of the most aged where the other end is reached. Frequently, again, that information which does not absolutely form part of the ordinary process of education, but which comes from unexpected quarters, is of as great a service in the development of the mind as any set lessons can possibly be. Whatever becomes suggestive to the mind is of educational value. That Museums have from their very nature the very essence of this suggestiveness is patent. It may be true that of themselves alone they are powerless to educate, but they can be instrumental and useful in aiding the educated to excite a desire for knowledge in the ignorant. The working man or agricultural laborer who spends his holiday in a walk through any well-arranged Museum cannot fail to come away with a deeply-rooted and reverential sense of the extent of knowledge possessed by his fellow men. It is not the objects themselves that he sees there, and wonders at, that cause this impression, so much as the order and evident science which he cannot but recognize in the manner in which they are grouped and arranged. He learns that there is a meaning and value in every object, however insignificant, and that there is a way of looking at things common and rare, distinct from the regarding them as useless, useful, or merely curious. These three last terms would be found to be the very common classification of all objects in a Museum by the uninformed and uninitiated.

After a holiday spent in a Museum the working man goes home and cons over what he has seen at his leisure, and very probably on the next summer holiday, or a Sunday afternoon's walk with his wife and little ones, he discovers that he has acquired a new interest in the common things he sees around him. He begins to discover that the stones, the flowers, the creatures of all kinds that throng around him are not, after all, so very commonplace as he had previously thought them. He looks at them with a pleasure not before experienced, and talks of them to his children with sundry references to things like them which he saw in the Museum. He has gained a new sense, a craving for natural knowledge, and such a craving may, possibly, in course of time, quench another and lower craving which may at one time have held him in bondage—that for intoxicants or vicious excitement of one description or another.

The craving for intoxicants or excitement is often as much a result as a cause. The toilers have few things to occupy their mind, and frequently in their home surroundings much cheerlessness and discomfort. Life is for very many a hard daily grind for mere existence, with little or no relief from the daily round of the struggle to make ends meet. These, and other conditions under which so many live, cannot fail to produce tastes and likings which are not qualified to tend to the uplifting of the mind and the desires by which their life is governed.

It is only those who come closely in contact with the more intelligent of the working classes, who know the nobility of character and the earnest reaching out towards higher things to be found among them, who can be familiar with the intense longing to have within their reach institutions such as Museums, Art Galleries, and Free Libraries, to which they can have easy access. That such as these use the institutions which already exist is most amply and conclusively proved by the ocular demonstration of those who have visited the Museums in any of the large towns of the country.

The nation should never forget that some of its greatest benefactors have belonged to this class of intelligent working men. James Watt, the engineer, Hugh Miller, the stonemason geologist, Stephenson, the collier-railway projector, Arkwright, the weaver-inventor, and scores of others who could be named. Where, indeed, should we have stood as a nation had it not been for the sturdy common sense of the intelligent and thrifty working classes?

Until very recently the great defect of our system of education has been the neglect of educating the observing powers—a very distinct matter, be it noted, from scientific or industrial instruction. The confounding of the two is evident in many books which have from time to

time been published. There are not a few who seem to imagine that the elements that should constitute a sound and manly education are antagonistic; that the cultivation of taste through purely literary studies and of reasoning through logic and mathematics, one or both, is opposed to the training in the equally important matter of observation through these sciences that are descriptive and experimental. There is considerable inconsistency in any such idea, and educational leaders are now universally recognizing the need there is for not giving too much attention to one class of mental training to the exclusion of the rest. Equal development and strengthening of all are necessary for the constitution of a well-ordered mind.

A consensus of opinion is now apparent that this method is erroneous, and the Universities are taking the lead by emphasizing to a less degree the merits of a purely classical education. The conductors of private schools, again, are beginning to see the great need which exists for a practical acquaintence with the leading Continental languages, and the Board school curriculum is rapidly becoming to mean a year or two devoted to technical instruction and manual training. It is almost impossible satisfactorily and effectually to conduct the latter without the aid of Museums, and these institutions are destined to occupy a most important place in this respect. Specimens of raw materials with labels clearly defining their properties and uses, and the relation that one kind of raw material bears to another kind, are now, in many instances, looked upon as indispensable scholastic aids.

The Manchester Exhibition was particularly useful in this respect, for there were many sections in which the various stages of the raw material up to the perfected article were shown, and it may safely be stated that no exhibition of modern times possessed in this way a wider and more real educational value than the very successful one held in Manchester in 1887. The silk, chemical, pottery, and other sections were especially complete in this respect. The number of models of an almost infinite variety in these departments had a value attaching to them as a means of instruction, which could not fail to be useful to the many thousands of the youth of both sexes who visited the buildings at Old Trafford.

Vast collections of objects, whether in Museums or Exhibitions for educational purposes, do not always accomplish the object in view. Doubtless the vastness of the collections in some of own Exhibitions in London, and those which have been held in other cities, has been very impressive, but it may be gravely questioned whether any mind has carried away many useful impressions from the infinite multitude upon which he has had an opportunity of looking. The general mental state very frequently produced by such a numerous display is that of distraction. There is such a state of mind as picture drunkenness or Museum drunkenness, and this should be carefully guarded against. There should be in Museums and Art Galleries a more extensive use of folding screens, so that anyone so disposed could shut themselves off from the crowd while they study a case or a picture minutely. A few striking objects well and carefully studied are infinitely better and of greater educational worth than a number of things at which there is only a casual glance.

Modelling, whether in cardboard, wood, or clay, is an invaluable means of cultivating and developing the manipulative skill of youths. All know how readily a boy will take to the construction of a boat, or a girl to dress a doll, and in this lies the indiction that most young people will take as readily to modelling as the boys do to cricket and the girls to their skipping ropes.

Charles Kingsley, addressing working men, with reference to their requirements, says: "We must acquire something of that industrious habit of mind which the study of Natural Science gives. The art of seeing, the art of knowing what you see, the art of comparing, of perceiving true likenesses and true differences, and so of classifying and arranging what you see, the art of connecting facts together in your own mind in chains of cause and effect, and that accurately, patiently, calmly, without prejudice, vanity, or temper."

The late Ralph Waldo Emerson, writing on the same subject, says: "Manual labor is the study of the external world." This kind of manual labor should be taught in schools. Children's habit of collecting and arranging objects of interest should be encouraged. The study of a single branch of natural science, such as constructive botany, may be made the means of cultivating habits of neatness, order and skill. The analysis of plant forms would illustrate the application of geometry to ornamental purposes, and open up wide fields for the development of decorative taste and manipulative skill. But cramped by the restrictive rules of our result system, these sources of useful culture are neglected; and, therefore, our children are turned out of the educational mill imperfectly prepared for the further processes necessary to qualify them for taking their part in the struggle for existence.

All this proves the necessity for Museums having the closest possible connection with elementary as well as advanced education. The uses of constructive botany, as referred to in the short quotation from Emerson, are especially helpful as a suggestive study to the mind. For this branch of education Museums are the best text-books which can be provided, but in order that specimens in these branches of natural science be properly and usefully studied they require to be explained by competent teachers. It is in this respect that practical and efficient curators can be of the greatest service in giving short and informal explanations of some of the specimens in their Museums.

As far back as 1853, there was delivered at the Museum of Economical Geology, in London, a lecture by the late Professor Edward Forbes, on the Educational Uses of Museums. In one part of this lecture he spoke as follows: "In their educational aspect, considered apart from their educational applications, the value of Museums must in a great measure depend on the perfection of their arrangement, and the leading ideas regulating the classification of their contents. The educated youth ought, in a well-arranged Museum, to be able to instruct himself in the studies of which its contents are illustrations, with facility and advantage. On the officers in charge of the institution there consequently falls a heavy responsibility. It is not sufficient that they should be well versed in the department of science, antiquities, or art committed to their charge. They may be prodigies of learning, and yet utterly unfitted for their posts. They must be men mindful of the main end and purpose in view, and of the best way of communicating knowledge according to its kind, not merely to those who are already men of science, historians, or connoisseurs, but equally to those who, as yet ignorant, desire to learn, or in whom it is desirable that a thirst for learning should be incited." Among the most useful Museums are those which are made accessory to professional instruction, and there are many such in the country, but almost all confined to purposes of professional education, and not adapted or open to the general public. The Museums of our Universities and Colleges are, for the most part, utilised in this way, but the advantages derived from them are confined to a limited class of persons.

This educating the children in the schools in the elements of natural science is most essential, especially in

country districts. When persons reach mature age without knowing anything about Natural History objects, they find it is then too much trouble to investigate these subjects. But by getting at them when young, by simple and forcible illustrations, they are bound to carry it forward with them to a certain extent, and if there should come a time when they are in a position to give time to study, the first they will take up and pursue with patience will probably be some subject of this nature, merely for the pleasure of the study. On the other hand, if they have no inclination to work, they will not forget the pleasant hours they spent when they sat listening to some explanation of an object so familiar, which will create a tendency to put their hands to the bottom of their pockets and act feelingly. If children could be taught to see God in Nature and the wonders which He controls, without cramming the brain with so much theory, by giving them a run into the country along with some one to explain, it would conduce a great deal more to their general health and happiness. Country Musueums want illustrating and simplifying as much as possible. Call a spade a spade, *i. e.*, give the local name as well as the scientific one. This education would be another great saving to the nation if it were universal. Half the things that are dug up now are only saved by the merest chance, because the men digging do not care what they are striking their pick through. This would be altered altogether if they had been taught in early youth to take notice of the value and interest there is attaching, often, to things dug up from the earth.

Thirty-five years ago Professor Forbes said: "I cannot help hoping that the time will come when every British town even of moderate size will be able to boast of possessing public institutions for the education and instruction of its adults as well as its youthful and childish population; when it shall have a well-organised Museum wherein collections of natural bodies shall be displayed, not with regard to show or curiosity, but according to their illustration of the analogies and affinities of organised and unorganised objects, so that the visitor may at a glance learn something of the laws of nature; wherein the products of the surrounding district, animate and inanimate, shall be scientifically marshalled, and their industrial applications carefully and suggestively illustrated; wherein the memorials of the neighbouring province, and the races that have peopled it, shall be reverently assembled, and learnedly yet popularly explained; when each town shall have a library, the property of the public, and freely opened to the well-conducted reader of every class; when its public walks and parks (too many as yet existing only in prospect) shall be made instructors in botany and agriculture; when it shall have a gallery of its own, possibly not boasting of the most famous pictures or statues, but nevertheless showing good examples of sound art: examples of the history and purpose of design, and, above all, the best specimens to be procured of works of genius by its own natives who have deservedly risen to fame. When that good time comes true-hearted citizens will decorate their streets and squares with statues and memorials of the wise and worthy men and women who have adorned their province—not merely of kings, statesmen or warriors, but of philosophers, poets, men of science, philanthropists and great workmen."

How far are we from yet realizing this ideal, and how slowly we seem to progress in so desirable a direction! Still there are many signs that the conscience of the nation is at last awakened, and if we see to it that all the discussions at present filling the air do not end simply in talk, but that practical good shall be the outcome, then our progress during the coming twenty-five years will not be so discouraging. In no better way can this ideal be realized than by an acute recognition of the place Museums should occupy in our national system of education.

LETTERS TO THE EDITOR.

**Correspondents are requested to be as brief as possible. The writer's name is in all cases required as a proof of good faith.

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

Feigned Death in Snakes.

After reading the letter on "Feigned Death in Snakes" in *Science* of Oct. 13, one is left with the impression that Heterodon, or the "blowing viper," or, as he is known in New Jersey, the "adder," actually bites itself in the side and then pretends to die.

As the adders are very common in the southern part of this state, I have had countless opportunities for watching this habit of feigning death and have never seen anything like an attempt, or even a pretended attempt, to bite themselves. The teeth of Heterodon are hardly large enough to scratch a tender hand, much less bite through or between the heavy folds of the snake's horny skin. How this supposition came about is easily seen, when the snake, after finding it cannot escape, is about to turn over on its back, throws its mouth wide open, tucks its head under its body and suddenly twists over, the whole affair, unless carefully watched, looks decidedly suicidal. But the snake has not bitten itself and had no intention of so doing.

The account referred to is quite right in believing that this is not a "faint from fear." The convolutions of the serpentine hemispheres are undoubtedly well twisted, but we can hardly credit the reptile with so delicately a balanced organism as to admit of its fainting.

The measure, I believe, is purely a protective one, and often of the greatest service. Heterodon is the slowest and most clumsy of all our snakes, and as it cannot depend on flight for safety, it needs other means for protection, of which this trick in question is among the best, as is also its beautifully adaptive coloration. The spewing out of the contents of the stomach is similar to that habit in turkey buzzards and many other creatures, and an additional aid in escaping their enemies.

The whole affair, then, is not a "pretended suicide" but a pretended death, with a stink solely for the snake's protection.

Dallas L. Sharp.

Bridgeton, N. J., Oct. 24.

The Destruction of Wild Plants.

The destruction of wild plants by students of botany and collectors has become appalling. Botany is becoming a universal study in the schools, and one hundred young people each gathering one plant to use and ten to twenty to throw away, soon exterminate the rarer plants.

The solution of the problem is at hand. Let teachers use only cultivated plants in their work. Of these an abundance can always be had. Turn the attention of students from the mere collection and analysis of plants to the more important subjects of plant physiology and economic botany. The time has come for a change.

G. G. Groff.

Lewisburgh, Pa.

Minnesota Mounds.

In reply to Mr. F. B. Sumner's criticism on my notes on Minnesota Mounds I would state that he should point out and correct some of my "gross misrepresentations" instead of indulging in absurd statements not bearing on the subject. Would also suggest that he read the article

again and with more care. Though Mr. Sumner has considerable ability in certain lines yet his youth and lack of special training should prevent him from criticising ideas acquired by considerable study and experience. Criticisms should be made with care.

ALBERT SCHNEIDER, M. D.

Weston, Ill., Oct. 26.

SLATE BLACK-BOARDS.

ATTENTION has been called to the fact that light is reflected from slate black-boards in an injurious manner. One city superintendent informs the writer that he has been compelled to lessen the amount of work to be copied from the board. A county superintendent writes that he cannot sit in a certain high school without experiencing painful sensations, if he faces the slate boards.

Have other teachers observed the same? Is a slate board more trying to the eyes than slated surfaces? Is a slated surface to be preferred to a true slate board?

Will not superintendents and teachers who care for the general health of the children in their charge, and especially for the eyesight of the children, communicate with the subscriber in reference to this matter? Answers to the questions are earnestly solicited. Address,

DR. GEO. G. GROFF,

Lewisburgh, Pa.

A GROOVED AXE IN A STRANGE PLACE.

SOME months since while making observations with Mr. Haldeman O'Connor, of Harrisburg, on an island in the Susquehanna, not far from the city, we came across a perpendicular exposure of a clay bed, from the face of which several feet of earth had been removed by a recent flood. Several bowlders were imbedded in its face and one of them, *eight feet from the top*, on account of its peculiar shape, attracted attention, and on removal proved to be a grooved axe, well made of a heavy, close-grained sandstone, about six and a half inches long and two and a half inches wide, having a good cutting edge and a perfect groove—somewhat weathered but not differing in any particular from the many found on the surface. The bed in which the implement was found is a compact clay, the lowest and the last of the terrace deposits of the valley and consequently, geologically speaking, comparatively recent.

Any method, save one, to account for the presence of the axe in this position, was of no avail. The clay bed seemed to be unquestionably undisturbed, and no theory of trap roots nor upturning of trees would explain it. Did the axe find this resting place—eight feet below the surface—during the deposit of the bed? If it did its maker, whoever he was, must have lived about the same time,—some thousands of years ago, when the last of the prehistoric floods swept down this old valley, and the origin of Neolithic man, if such he was, must be placed at an early date. HARVEY B. BASHORE.

West Fairview, Pa., Oct. 1.

THE SYSTEMATIC POSITION OF THE DIPTERA.

IN *Science* No. 558 for October 13, Dr. Packard has an article upon this subject, in the general conclusions of which I most heartily agree. Dr. Packard has not mentioned, by any means, all of the arguments in favor of his view, and some of these will be, I hope, presented by Dr. Riley, who has already suggested them in lectures,, although they are not, so far as I am aware, published. There are a few points upon which Dr. Packard's paper is not entirely clear, or where, at least, I do not seem to be able to understand him entirely. He mentions, in one place, as characteristic of the Diptera the "abolition of mandibles (Simulium excepted)." In another place, the fact that the jaws are wanting, and finally speaks of the mosquito, especially the female, in which mandibles and maxillæ are said to be well developed. The first statements are correct; but I must take issue with Dr. Packard on the statement that the mandibles are well developed in the mosquito, for, as a matter of fact, there is no trace of these organs in that insect. All the piercing and enveloping structures are, as I have shown, homologous with other mouth structures. It is further stated that the maxillæ are usually much reduced, while the labium is enormously developed and highly modified. I have, I think, shown very conclusively that the enormous development in the Dipterous mouth parts takes place in the maxillary structures and that the labium is in most cases very much reduced if not entirely wanting. The best development of this latter organ is seen in the piercing flies related to *Tabanus*, in which we are able to trace every part of the normal structure of the labium of a mandibulate insect. Dr. Packard's article reads as if he partially accepted and partially rejected my conclusions concerning the mouth structures of the Diptera, and I would be rather interested to know how far he considers my conclusions in that order well founded. The reference to the mouth parts is really not needed in order to support his claim, and in some directions the Dipterous mouth is certainly very much more highly specialized than that of the Hymenoptera. JOHN B. SMITH,

Rutgers College, November 1st.

BOOK-REVIEWS.

A Guide to Stereochemistry, based on lectures delivered at Cornell University, with an index to the literature. By ARNOLD EILOART, Ph.D., B.Sc. New York, Alexander Wilson, 26 Delancey street. 96 p. with appendix, paper, 8vo., Ill. $1.00, postage free.

THE want of a suitable text-book upon this deeply interesting new branch of chemistry, the geometrical relations of atoms in space, has long been felt. The literature is widely scattered and so fragmentary as to make such a "Guide" as this offered by Dr. Eiloart of utmost value to student and professor alike; to the latter as an aid in the preparation of his lectures and to the former as a digest of these lectures, with an indication of the lines and means for more extended study. Unfortunately, in many colleges this department of research is barely touched upon, not for lack of interest, however, but because with the limited time commonly at the disposal of the professor detailed correlation even of the work in this field is an impossibility.

While the study of structural isomerism dates from 1824, the actual development of stereochemistry begins about 1873—a retardation of extraordinary length, considering the easy step from one to the other. Isomerism conceives of compounds containing the same elements in the same proportions, and yet differing in properties, this difference being due to a different grouping of these elements. Geometrical isomerism conceives of compounds containing the same elements in the same proportions and arranged in the same groups and yet differing in properties because of a different arrangement *in space* of the constituent groups. The second conception is thus a natural outgrowth from the first. Dr. Eiloart passes with a few words the accepted facts of stereochemistry giving more particular attention to the living issues and more daring developments. The index to the literature is most carefully planned and is more than a mere list of titles, insomuch as it gives by means of suitable abbreviations an idea of the contents of the papers referred to. An appendix with photographic plates, five in number, treats of the use of "Solid Formulæ," or models in the teaching of organic chemistry. The book is copiously illustrated throughout with diagrams and woodcuts. C. P.

Primer of Philosophy. By DR. PAUL CARUS. Chicago, Open Court Pub. Co., 12mo., $1.

THIS book, notwithstanding its title, is the most elaborate work on general philosophy that Dr. Carus has yet published. The philosophical system that he advocates is in the intellectual sphere what he calls positivistic monism, and in the moral sphere meliorism. By monism he means that "soul and body, * * * are the too inseparable sides of our existence; they are two abstracts from one and the same reality" (p. 23). His monism evidently is the kind that is known as materialistic monism; for he does not believe in the soul as a distinct entity, but says that "a human personality is merely a society of ideas." The main object of this book, however, is to set forth the author's views on the subject of what Kant called *a priori* truths, and to reconcile, if possible, the views of Kant with those of Mill. Dr. Carus holds with Kant that "logical, mathematical principles are universal and necessary;" but on the other hand, he maintains with Mill that all our knowledge comes from experience. The question he has to answer, then, is how universal and necessary truths can be derived from experience, which consists entirely of particular perceptions; and we cannot think that Dr. Carus is any more successful in answering this question than others have been before him. He sees that universal truths cannot be get out of sensuous experience, yet he cannot accept Kant's view that they are known before experience; and he advances the opfnion that such truths, or axioms, are "products of rigidly formal reasoning." To this the obvious reply is that there can be no formal reasoning without premises, and that, if the conclusion is to be valid, one of the premises must be universal; and furthermore, the principle of reasoning itself must be universal if the conclusion is to be sound. But while we cannot think that Dr. Carus has solved the problem he has taken in hand, we have been interested in reading his book and have found much in it that is suggestive. It shows throughout the moral earnestness and the desire to be useful that mark all its author's works, and will well repay perusal.

Essays on Rural Hygiene. BY GEORGE VIVIAN POORE, M. D., F. R. C. P. London and New York, Longmans, Green, & Co. 321p, 8 vo.

FOR thirteen years honorary secretary and subsequently vice-chairman of the Parkes Museum of Hygiene, Dr. Poore is well qualified as an experienced sanitarian and his word in hygienic matters carries the weight of practical experience. Many of the chapters of the abovenamed work has been previously published, while others have been delivered as addresses before the University College, London, and before various scientific societies. The book has, however, a perfectly preserved plan and is in no sense a disjointed collection, nor does the former publication deduct from the interest, as unfortunately Dr. Poore's ideas of sanitation are totally at variance with the popular acceptance of that term and are not such as would be given wide publicity. The world has accepted very quickly the call for improved sanitary methods finding the subject, considered as a principle, one readily grasped by minds little trained in the sciences, and at the same time one which appeals very closely indeed to the comfort and health of the home. Unfortunately, however, this fervor of sanitation has opened the path for hundreds of banditti patentees and political highwaymen who have quickly seen andappreciated their opportunity, and who, from the ambush of "science" have rushed out and seized upon the public pocket-book. That the public has made so little resistance and has always so smilingly "held up its hands" is perhaps to its credit in a way, for it thereby exhibits a readiness to co-operate with science and it can not be expected to distinguish between the true and the false. But people like to pay well for public improvements and very probably if offered their choice between the modest and enonomical means proposed by Dr. Poore, and the criminally expensive processes urged by city boards, would unhesitatingly prefer the latter. We rather like beiug robbed by gallant knight of the mountains with bright colored scarfs and ornamental trappings. We can talk about it afterwards, boast of it in fact, and the more we have lost the prouder we are.

A point well developed in these essays is the evil of concentration of population, and, together with this, the ever-growing problem of proper water supply and of sewage disposal. The question of pure air is discussed, and also the purifying power of "the living earth." Cities now committed to the evils of expensive and wasteful water supply, with all the accompanying difficulties and snares of sewage and sewage disposal, Dr. Poore very properly leaves without his discussion; they have gone so far as to make a turning back well nigh impossible. Where the end will be he does not even conjecture. It is to the rural and suburban population that he appeals, and most ably, for a consideration of certain means by which, upon a thorough scientific basis, they can secure an efficient sanitation for their homes, a pure water supply and an increased land value, all at a minimum of cost. Nor is this rested upon theory alone; the practical working in all details has been developed in the author's suburban home, and the same means there used by him are open to all of us who have that blessing of a small piece of ground, and who are not condemned to live in a "flat." C. P.

A Laboratory Manual, Containing Directions for a Course of Experiments in Organic Chemistry. By W. R. ORNDORFF, A. B., Ph.D., Assistant Professor of Chemistry in Cornell University. Boston, D. C. Heath & Co. 1893. Interleaved.

THE above manual is designed to accompany Remsen's "Organic Chemistry," and is systematically arranged as a laboratory companion to that book. It contains a course of experiments, eighty-two in all, graded in careful manner, leading on from the elementary principles of organic analysis, fractional distillation, the determination of melting points, etc., to the more advanced synthetical preparations. The procedure of the various operations is admirably given in few but comprehensive directions, and the experiments as described would present no difficulties to a beginner in the study. While parallel to Remsen's book, it is more explicit, and gives greater detail of manipulation. The author's experience as a teacher has enabled him to select carefully the best conditions of experiment and to present them clearly to the student. C. P.

—D. Appleton and Company have published a large octavo volume containing "Speeches and Addresses of William McKinley." They are mostly of a political character, and, as will be surmised, a large number of them are in advocacy of the protective tariff. Mr. McKinley is well known, not only as one of the leading advocates of the protective system, but also as the author of the existing tariff, and his prominence in the matter will make this book useful even to his political opponents. His views are so generally known, however, that we need not expound them here, and any discussion of them or of the protective system in these columns would be out of place. He expresses himself clearly and forcibly, and whoever wishes to become familiar with the protectionist theory in its extreme form will find it set forth in these pages. Many of the speeches in this volume, however, are on subjects of an unpartisan character, such as those commemorating the life and work of Grant, Garfield and other prominent men, together with several delivered on anniversary occasions. The author's enthusiastic patriotism—sometimes too enthusiastic, as it seems to us—appears in almost all of them, as well as his straightforwardness and earnestness. The general reader will be particularly pleased with his remarks on the public school system and his eulogy of the early New Englanders, and with his hearty appreciation of the eminent men whom he has known in public life. His strong partisanship, which shows itself so often, is not always pleasing to men of more moderate views; but in a country that is governed by parties it is necessary to know what the party leaders are thinking, and in this respect this volume will be useful to all students of American politics.

EXCHANGES.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

For exchange.—Skins of Aegialites nivosa, Ereuneter occidentalis, Aunnodramus Arldingi. A. rostratus, Chamara fasciata henshawi, etc., for native or foreign skins with full data. Send lists. A. W. Anthony, 2042 Albatross st., San Diago, California.

I have a Beck New National monocular microscope, accessories, microtome, mounting material and a large number of fine slides. Will exchange the whole or in part for a first class type-writer or photograph outfit. A. C. Gruhlke, Waterloo, Ind.

Offered sidebloom eggs of Bulimus oblongus and exotic land and freshwater shells in exchange for Helices not in collection. Send lists to G. K. Gude, 5 Gresbach Road, upper Holloway, London, England.

Would like to exchange 100 specimens of Canadian Indian Relics for a photo outfit. E. J. Waters, 33 Hoffman St., Auburn, N. Y.

For Sale.—A collection of fossil Rhinoceros bones (Aphelops fossiger Cope.) from the Loup Fork Tertiary, including all the bones of one fore and one hind leg, the pelvis, representative vertebrae and ribs, and a nearly complete skull, with complete lower jaws. All the bones of the limbs are perfect. Price $250. Address Dept. of Paleontology, University of Kansas, Lawrence.

Wants.

WANTED.—Tuckerman's Geneva Lichenum and Carpenter on the Microscope. State price and other particulars. Richard Lees, Brampton, Ont.

WANTED.—Icones Muscorum by W. D. Sullivant, with or without Supplement, but both preferred. Address, stating price and condition of books, Dr. G. N. Best, Rosemont, N. J.

WANTED.—A copy of Mascart & Joubert's Lessons in Electricity and Magnetism, Vol. I. Address R. W. Clawson, Vanderbilt University, Nashville, Tennessee.

CHEMIST.—Graduate of a polytechnical school, and studied photographic chemistry in Germany and Austria. Situation teaching or in analytical or experimental laboratory. M. B. Punnett, Rochester, N. Y.

WANTED.—A recent college graduate to assist in editorial work on Science. Those seeking large emoluments need not apply. N. D. C. Hodges, 874 Broadway, New York.

A GRADUATE in medicine, experienced, will prepare or revise scientific and medical manuscript for publication, read proof, compile bibliographies, &c. Will also consult New York libraries for persons out of town wishing references to rare works. Address M. D., 104 Cambridge Place, Brooklyn, N. Y.